

CLAIMS

What is claimed is:

1. A system for thermally processing materials comprising:
5 a furnace housing having a furnace chamber;
a support assembly disposable in the furnace chamber for supporting the materials to be thermally processed;
a microwave heating source operative to heat materials in the furnace chamber;
10 a convection/radiation heating source operative to heat the materials in the furnace chamber; and
one or more eductors each having an outlet located in the furnace chamber to provide circulation of gas within the furnace chamber.
15
2. The system of claim 1 including a plurality of eductors on first and second sides of the furnace chamber for providing a uniform gas atmosphere in the furnace chamber.
- 20 3. The system of claim 1 wherein the microwave heating source comprises a variable frequency microwave heating source.
4. The system of claim 1 wherein the microwave heating source comprises a multi-frequency microwave heating source.
- 25 5. The system of claim 1 wherein the support assembly includes an elevator hearth moveable between a lower position for loading and unloading of materials to be thermally processed, and an upper position for disposing the materials in
30 the furnace chamber.

6. The system of claim 1 wherein the eductor includes a tubular body having a nozzle in communication with a gas supply and providing high velocity gas into the furnace chamber and disposed to entrain gas in the furnace chamber to provide high volume circulation of gas within the furnace chamber.
7. The system of claim 1 wherein the microwave heating source is operative during a portion of the heating cycle.
8. The system of claim 1 wherein the microwave heating source is operative for a period of time during a heating cycle when the materials being processed are at a temperature to be microwave receptive.
9. The system of claim 1 including a controller for controlling the microwave heating source and the convection/radiation heating source to provide an intended thermal profile during a heating cycle.
10. The system of claim 9 wherein the controller controls the gas flow of the one or more eductors.
11. The system of claim 1 wherein the one or more eductors are operative to provide forced convection cooling of the materials during a portion of a thermal cycle.
12. The system of claim 1 including a plurality of eductors.
13. The system of claim 1 including at least one eductor on each side of the furnace chamber and operative in alternating

manner to provide uniform circulation of gas in the chamber and uniform heating of the materials.

14. The system of claim 1 wherein the furnace chamber
5 includes a hearth having a plurality of openings extending through the hearth from one side of the furnace chamber to the other side of the furnace chamber;

and wherein the one or more eductors includes a plurality of eductors on first and second sides of the furnace chamber,
10 each pair of eductors on respective sides of the furnace chamber being in line with a respective opening through the hearth.

15. The system of claim 14 wherein each of the eductors is
15 disposed in a sidewall opening of the furnace housing.

16. The system of claim 1 wherein the convection/radiation heating source includes one or more electrically energized heaters disposed in the furnace chamber.

20

17. The system of claim 1 wherein the furnace chamber is in a batch furnace operative to have materials loaded therein for processing and unloaded after processing.

25 18. The system of claim 1 wherein the furnace chamber is in a continuous furnace operative to have materials conveyed therethrough during a processing cycle.

19. A system for thermally processing materials containing
30 ceramic or metal powder retained in a binder comprising:

a furnace having a furnace chamber;

a support assembly disposable in the furnace chamber for supporting the materials to be thermally processed;

a microwave heating source operative to introduce microwave energy into the furnace chamber to heat the materials disposed therein;

a convection/radiation heating source in the furnace chamber and operative to heat the materials disposed therein;

one or more eductors operative to provide a high volume circulation of gas within the furnace chamber; and

the microwave heating source and the convection/radiation source being controlled during a first portion of a heating cycle to remove the binder from the materials being processed, and being controlled during a second portion of a heating cycle to sinter the powder into a monolithic mass.

20. The system of claim 19 wherein the convection/radiation heating source includes one or more electrically energized heaters disposed in the furnace chamber.

21. The system of claim 19 wherein the microwave heating source comprises a variable frequency microwave heating source.

22. The system of claim 19 wherein the microwave heating source comprises a multi-frequency microwave heating source.